

POSIDON Science Flight Report

2016-10-25 RF07

Takeoff: 0342 UT October 25 (13:42 Oct 25 Guam local)

Landing: 0810 UT October 25 (18:10 local), duration: 4.5 hours

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Pilots: Gregory Johnson, Dom Del Rosso

Summary:

This flight provided measurements of trace gases and ice crystal microphysical properties in anvil cirrus after the convection had subsided and in cold cirrus near the tropopause. Enhanced ozone concentrations in the uppermost troposphere were also measured on this flight.

Flight Description:

On the morning of the flight, an active convective system was south of Guam at about 10°N, providing an ideal opportunity for devoting an entire flight to sampling trace gases and cirrus detrained from a tropical deep convective system.

The takeoff was delayed a few hours for repair of the canopy lock system. By the time the aircraft headed south toward the convective system, all of the active convection had collapsed, but cirrus produced by the convection was still persisting. The aircraft flew south to about 9.5°N and then headed across the remnant anvil cirrus toward the west and flew a racetrack pattern across the cirrus (Figure 1) while porpoising between 45 and 55 kft (Figure 2). Thin cirrus was apparent in the upper part of this altitude range near the tropopause where relatively high ozone concentrations (sometimes exceeding 100 ppbv) prevailed. The aircraft dipped into the convectively-generated cirrus below about 46 kft, where the ozone mixing ratios decreased to about 20 ppbv. Since the higher cloud layer was extending above 55 kft, we raised the tops of the ascents to 57 kft.

As the anvil cirrus layer appeared to be moving and dissipating, the eastern waypoint of the racetrack pattern was shifted north to about 11°N. Also, we were cleared to descend as low as 43 kft at the bottom of the descents for the remainder of the flight. We continued to see low ozone values and cirrus at the bottoms of the descents, and thin cirrus extending up to nearly 57 kft where high ozone prevailed. As the lower cirrus layer continued to dissipate, we sent the aircraft further east for an additional profile downstream, then crossed the region and headed west of Guam to provide profiles of tracers upstream of the convective system.

The aircraft ascended to over 60 kft en route back to Guam and spiraled down over the location west of Guam where the frostpoint/ozone balloon sonde (launched from Guam) was predicted to

be as it passed through the TTL. This spiral provided excellent water vapor and ozone comparisons with highly supersaturated air observed near the tropopause over Guam (Figure 3). Preliminary DLH data indicates water vapor concentrations slightly higher (a few tenths of a part per million) than the frostpoint measurements.

All instruments performed well except the vapor channel of the NOAA-H₂O instrument failed toward the end of the flight. The problem was resolved after the flight.

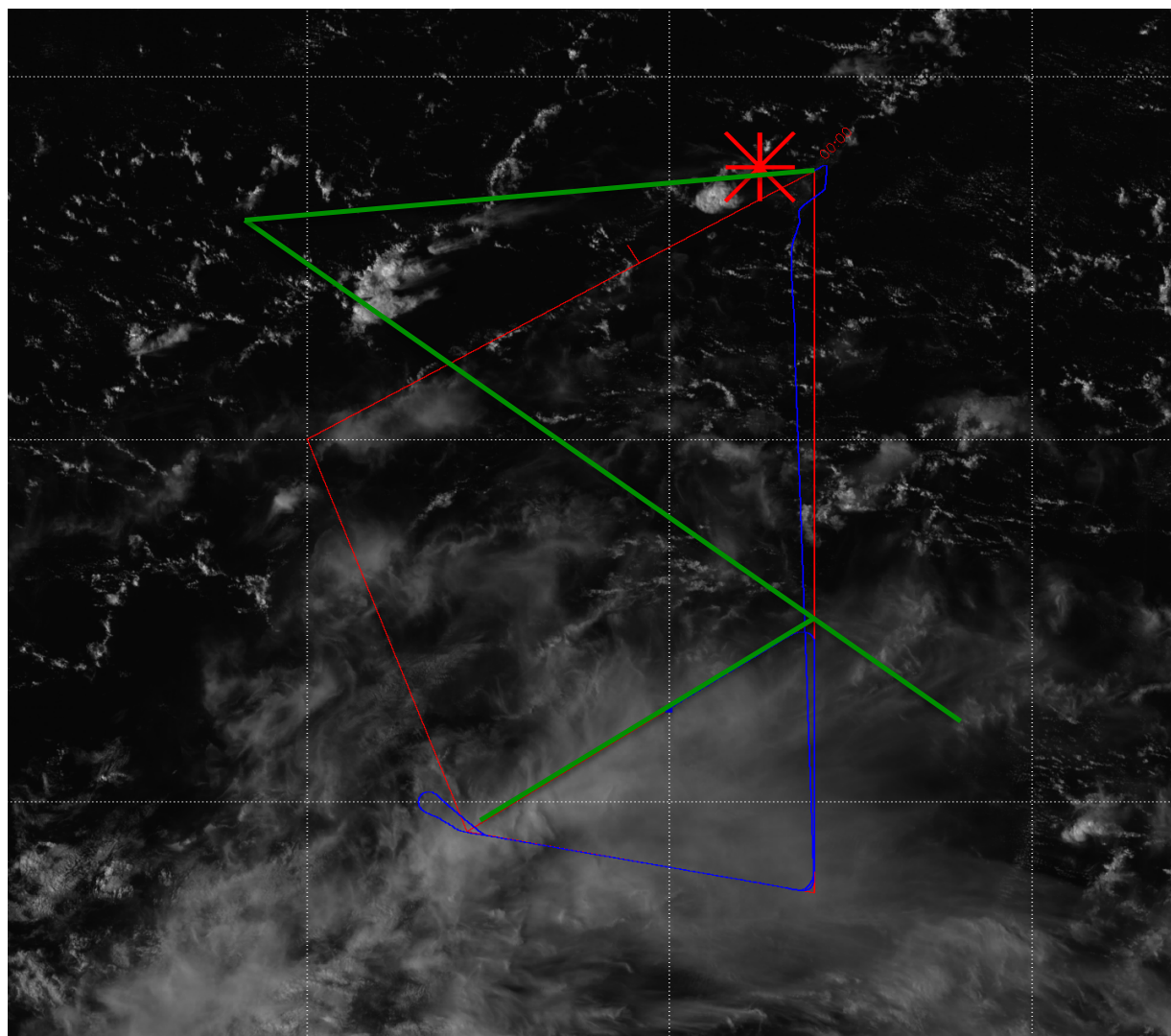


Figure 1. Visible satellite image during the sampling of cirrus and trace gases left behind by convective system south of Guam. The blue line shows the flight path up to the approximate time of the satellite image (0500 UT), and the green line shows the approximate flight path for the remainder of the flight.

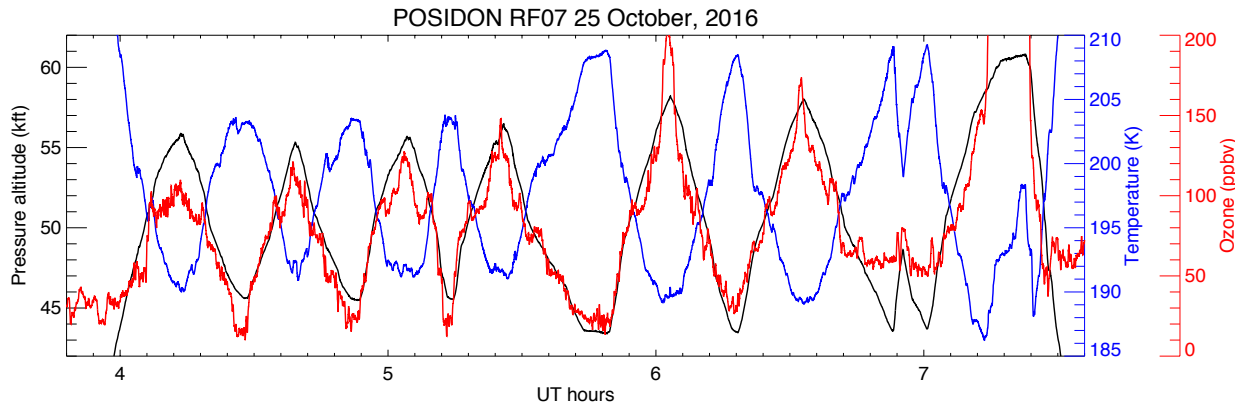


Figure 2. Time series of pressure altitude, static temperature, and ozone mixing ratio.

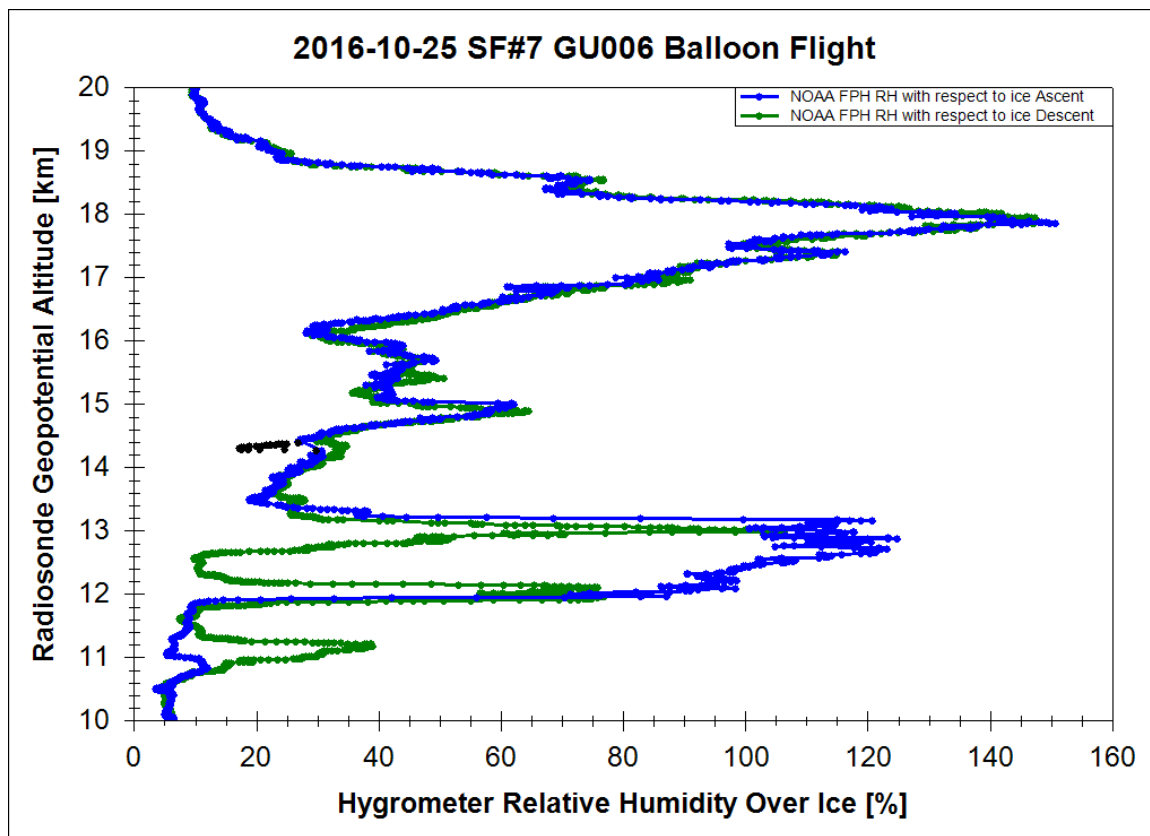


Figure 3. Vertical profile of relative humidity with respect to ice versus altitude from the frostpoint balloon sonde launched at Guam (Courtesy Allen Jordan and Emrys Hall).